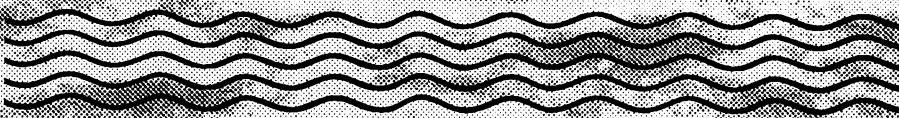


Harpoon TACTICAL GUIDE



by Larry Bond

I

INTRODUCTION

This section provides a hands-on guide to winning a game of Harpoon. Just as Harpoon is not meant to show you all the problems of a real-life fleet commander, this section does not try to teach you everything you need to be a real-life commander. Harpoon concentrates on some of the major tactical decisions a real-world admiral would have to make in a war at sea. This is where you can look to understand why the decisions have to be made, and what the possible results could be.

NAVAL WARFARE TODAY

Modern naval warfare differs radically from the classic naval warfare of World War II. In 1939, at the start of that war, there were few types of naval units, and few things they could do to each other. Surface units fired guns or torpedoes at other surface units, fired guns at aircraft, and dropped depth charges on submarines. Aircraft dropped bombs or torpedoes on ships, and dropped depth charges on submarines. Submarines torpedoed merchant ships, taking on warships only if they were in the right place at the right time. The only sensors available were sonar (brand new and overrated), radar (still secret), and the lookout's eyes.

Naval warfare fifty years later is totally different. New classes of weapons and sensors have given entirely new types of capabilities to naval vessels, aircraft, and submarines. The helicopter, nuclear propulsion, nuclear weapons, FLIR (Forward Looking Infra-Red), guided missiles, and many other systems have spread across the naval spectrum and multiplied the possibilities for detection and destruction of an opponent.

Where before armored dreadnoughts or hundreds of carrier aircraft slugged it out, now one aircraft, one missile, or even just one decision may decide the victor. The rare accounts of modern naval combat reveal it to be much more intense than World War II, compressing the same violence into a fraction of the time. In World War II, ships steamed in column and then deployed into battle formation; reaction times were measured in hours. Naval units today must always be in combat formation; attacks may be launched within seconds of detection.

As might be expected, the capabilities of naval weapons have been improved since 1939. Naval guns, their basic nature unchanged, have increased in range and accuracy. Torpedoes run farther, faster, and are smarter than their World War II counterparts. Radars have greater range, greater resolution, and greater reliability. Everything that the belligerents used in World War II is still used, but with greater power and greater effectiveness.

As also might be expected, totally new naval capabilities have been developed since World War II. Technology has produced new naval weapons and equipment to meet the needs of modern naval operations. Helicopters give even small ships an ability to increase their range and ability to project attacks. Satellites allow naval commanders to detect and target surface ships that have not been seen by any friendly naval unit. Missiles make the smallest ship an adversary for the largest. Countermeasures make ships invisible to sonar or radar. And as new naval capabilities are added to the inventory, the options (and the problems) facing the naval commander increase.

Technology is the driving force behind these new capabilities, and naval warfare is much more subject to technology than land warfare. On land, the dominant force remains the individual infantryman; technology has not (yet) changed this fact. At sea, however, the development of a new

weapon or even a new sensor can have a dramatic effect, unobstructed by terrain or human limitations. Sea warfare is machines fighting other machines, with men directing them and serving as parts of the machine to do things it cannot. Ever since war at sea became mechanized, the goal has been to remove men from the loop, to maximize speed and efficiency. Automatic gun mounts remove men from the loop, so do heavily automated propulsion plants. Not only are men removed from dangerous and nasty jobs, but response time improves and a ship's manpower support overhead is reduced. The ultimate example to date is the Aegis system: it detects, classifies, and engages hostile air targets without human intervention (although under human direction). Advanced technology makes this system possible, but it also increases the burden on the man ultimately responsible, the naval commander.

What does this mean for the naval wargame? Technology is complex and expensive, with lots of little details and limitations that can overwhelm a player. A game must show the players the significant details, and ignore the rest. Some details are just not important to the player at his level of control. A ship or formation commander is not interested in the maintenance record of the aircraft, or the exact frequency settings of his sonars; his junior officers take care of that and let him handle the big picture.

Harpoon keeps detail at a level appropriate to the player's role as a naval commander. The game assumes that his guns are firing the correct ammunition, and that the target is in range. If it is not, the guns won't fire. The player concentrates on strategic decisions. Should he order two ships out as pickets to scout for the enemy? Should he retain them to increase the defensive strength of his formation? The player, as a ship or formation commander, gives orders such as: Engage that target with guns, or Send a two-ship group to see if the enemy force is in that direction. A task force commander's role is to resolve tradeoffs, and decide, sometimes on the basis of faulty and incomplete information, on the best course of action.

Harpoon shows the player what kind of decisions must be made by a ship or battle group commander when he fights a modern sea battle. It shows what information the commander has, and how he uses it to make those decisions. Most importantly, it allows the player to make those decisions, and to see their results in a simulated combat setting.

All this makes Harpoon sound like a very serious simulation, but any wargame attempts to do this. I just want Harpoon players to understand that they can use the game not just to bash away at each other in a structured way, but to understand what is happening out on the oceans of the world. It can be used to recreate recent naval engagements such as the Falklands or the Persian Gulf, or to look at current issues, such as convoys going to the Central Front in Europe, or the role of the reactivated battleships.

While I call Harpoon a game, there is no built-in play balance; it is more accurately a simulation. The data are a reflection of real-world weapons and equipment, used with a game system that allows them to interact. Tactics useful in the real world work in this simulation. Whether one player or the other will win 50 percent of the time, I can't say; that depends on the initial setup and the skill of the players, which is, after all, what it's all about.

Every player will learn some naval tactics while playing Harpoon. He will learn the relative value of naval units, and how they work together. He can reenact recent naval combats and see what forces were at work, or try out hypothetical units only on the drawing board now, and see if they are worthwhile. In the long run, he will be able to appreciate how this coun-

try's naval forces serve our national interests.

But no player has to understand modern naval warfare in order to play Harpoon. The rules and the game stand by themselves. With each game and with experience, an understanding of naval warfare will come naturally. These rules assume a basic understanding of elementary terms (which have readily available dictionary definitions) like cruiser, destroyer, sonar, or radar. Anything beyond a basic knowledge of naval terms is explained in the appropriate rules section.

In the design of Harpoon, I had to make some basic assumptions about the way that units interact to produce what I considered a realistic result. These assumptions underlie the game, and strongly influence the way it should be played.

1. The hardest part of naval warfare is finding and fixing your opponent's position. This was so in WW II, and it is more so now. The proliferation of sensors has not greatly helped the initial detection process.
2. A ship is relatively easy to kill. In WW II, ships could suffer many shell or bomb hits without its fighting efficiency being destroyed (sunk). A modern ship has many fragile systems to be damaged, and far less armor. Consequently, a single solid hit will often cause enough critical hits to make it ineffective (a mission kill).
3. Reactions today must be much faster than in WW II. Most WW II naval wargames use turns of five or six minutes. This represented the amount of time it took commanders to determine trends and then give orders based on the information they had gained (the decision cycle). Because of the speed of current threats, ships must react much faster. This makes the high-speed tactical maneuverability of a ship much less important than in WW II. When a missile moves at 600 knots and a ship moves at 30 knots, the relative motion of the ship is irrelevant, except for turning to unmask its batteries.

Finally, all information used in this game has been drawn from unclassified Navy or civilian sources. What I have done is amass information from many different sources, compare it and try to resolve differences, and use the best, most current, most commonly available values. I have also noted books or publications that I recommend as providing good summaries and background in various topics, or as being the most accurate and useful publications for a modern naval gamer to add to his library.

The information in this game is as accurate and up-to-date as possible, but data like weapon kill probabilities and exact ranges can vary widely from source to source. Even prestigious books like Jane's Fighting Ships and Combat Fleets of the World must sometimes publish best guesses on a weapon's or a sensor's performance. Data on the physical features of a ship or aircraft or missile are easier to come by. Performance information is suspect in any case because it is based for the most part on test firings made under ideal conditions. There is only a small body of combat data by which to judge effectiveness. Modern game designers must accept that when the systems they describe are actually used for the first time, some will do very well, most will perform a little below advertised performance, and a few will prove to be utter failures. There is no way to predict which will be which.

PRINCIPLES OF MODERN NAVAL WARFARE

The basic goal of any sea fight is to destroy the enemy. To do that, you must inflict enough damage on him to destroy his ability to fight, while preserving your own forces. You may be able to fight without loss, but at a

minimum you must retain enough capability to accomplish your mission, whatever it is. It does you no good to win a sea battle and lose so much of your air group that you cannot protect the convoy you are supposed to escort.

Captain Wayne Hughes has written what is rapidly becoming a standard work on modern naval combat. It is called *Fleet Tactics*, and it provides the single best rule for fighting at sea today.

ATTACK EFFECTIVELY FIRST.

This one sentence reflects the technology and dynamics of modern naval warfare.

As Captain Hughes describes in his book, the weapons of today are fast, and violent, but limited. Instead of firing round after round out of big guns, a ship will fire a salvo of missiles, either at attacking aircraft or at another ship. Much more so than WW II, a ship has a limited number of shots, and must often go back to port to reload. Even the weapons that can be reloaded at sea will need a long time, and there are a limited number of reloads in the national inventories.

Also unlike WW II, an attack by another ship can be blunted, or even defeated. There is no way to stop a gun shell or bomb. Missiles can be jammed or shot down.

Why use missiles, if they can be stopped? Because of their range. The best gun of WW II, the 16"/50, had a maximum range of approximately 20 nautical miles. Its effective range was less. The Exocet, one of the first surface-to-surface missiles used by the west, has a range of 22 nm, and it is now considered a "close-in" weapon. The US Tomahawk has a range of 250, and the Soviet SS-N-12 of 300 nm.

Also, a missile's warhead is much bigger than most shells. One missile hit will cripple most ships, and two or three will annihilate all but the largest.

But these powerful, long-range missiles are large, and a ship can only carry a limited number of them. If they were smaller, they wouldn't have the range or punch needed.

So a warship will have a single, powerful attack that it can launch at some target. It must make that shot count, it must attack effectively, so that it is not wasted.

Second, the enemy's missiles are just as large and powerful as yours. Although there are defenses, such as electronic jamming, guns and missiles, no defense is perfect. Do you want to bet that you can stop the enemy's missile attack cold? Just trading shots with the enemy is not a smart way to fight.

Thus you must attack first, with your missiles ideally hitting him before he launches. What that attack consists of, or how it is actually conducted, will be discussed later.

METHODS OF ATTACK AND GOALS

When you do attack, remember that an effective attack will concentrate enough firepower to destroy or cripple the enemy. No half-measures. Often, beginning players will fire a medium-strength attack, to "feel out" his defenses, or because they want to hold part of their firepower "in reserve".

These terms relate to warfare on land, where both firepower and the defenses are much more diffuse. It can take several hours to see the trends in an attack on land but a missile attack can be over in minutes.

The principle to use in conducting an attack is concentration of mass, of directing your firepower effectively at the most important ships. Don't try

and destroy his entire force. Even the most violent battles of WW II inflicted losses of less than 50% on both sides. Instead, attack the enemy's mission. If he has to launch an airstrike, attack the carrier. If he is conducting an amphibious landing, he can't do it without the troopships. The escorts are present only to defend these valuable targets.

There is one attacking strategy, called "rollback" where the first wave attacks the escorts, allowing a second wave to attack the high-value targets. This technique should be used carefully, since a missile that hits an escort could be hitting an important target instead. Only attack the escorts if the effort expended to defeat an enemy is reduced by your choice.

This technique can be used best when two or more types of attack need to be combined. For instance, missiles might be used to make a hole in the outer screen of escort ships, then submarines close and torpedo the heavies.

Other combinations will suggest themselves as your experience grows. The guiding principle must be to defeat the formation as a whole, not just sink the most ships.

SCOUTING AND COUNTERSCOUTING

The biggest problem is not launching an attack, but knowing where to attack. Finding the enemy, while remaining hidden from his search, is the first step. The ocean can either be viewed as an endless expanse of space, with the enemy impossibly small, or as a flat surface with nowhere to hide.

Captain Hughes describes this critical part of naval warfare as scouting and counterscouting. The idea is to find him without revealing your own presence.

A search can be active or passive. A visual search is passive. Listening on sonar is passive. If that sonar sends out pings to listen for echoes, it is active. Another ship can hear those pings. They learn your direction, from the direction of the pings, and the type of sonar you have, from the type of ping it makes.

Similarly, radar sends out pulses or electromagnetic energy and displays echoes from aircraft or ships on the radar screen. An enemy unit that has a specialized radar receiver (called an ESM set - for Electronic Support Measures) can detect the direction of your radar signal and the type of radar you are using. Two enemy units far enough apart can compare the bearing of your signal and figure out your exact position.

Radar provides a commander with valuable information - how many of the enemy are there, where they are going, and their precise position. But by using radar you give the enemy vital information - your general direction, possibly your exact position, and something about your identity.

The same thing holds true of sonar, even of visual search, since if he can see you, you can see him.

The answer is to know the strengths and weaknesses of each sensor, and also how it is affected by the environment. For instance, some types of sonar are halved by the thermocline and others are not. Placing yourself across the thermocline may help hide you but not affect your ability to detect the enemy. The specific sections on various types of warfare will provide hints and common sensor tactics, but don't stop with these. Understand the way the sensors work.

MISSIONS

Naval forces do not exist simply to attack other naval forces: There are several classic "roles" of warships, things like sea control, power projection, but these are general descriptions, not concrete tasks.

Most of the tasks that are assigned to naval forces, especially in wartime,

are part of the following list: nuclear deterrence, convoying ships from place to place, or attacking land targets, either on their own or in direct support of an amphibious attack. Conversely, you can also attack naval forces that are trying to accomplish these missions.

All of these tasks relate in some way to the land: possible nuclear strikes against an enemy country, getting ships with cargoes from one port to another, or directly attacking a target on land. You can lose a war at sea, but you can only win it on land.

Always be aware of the overall mission, and every action you take should be to ensure that mission's success. Also, take any action you must to make the mission succeed. There is a difference.

For example, a ship escorting a convoy detects a submarine. You will of course order the ship to attack, but what about turning the convoy away from the sub? This presents the enemy with a more difficult target.

Above all, avoid a slugfest, where you and the enemy exchange fire. Attack his weak points. Flee if he is too strong. Do not give him an even break.

MANAGING YOUR FORCES

Whatever your mission, you will be given units (hopefully enough of the correct type) to accomplish it. How do you put these pieces together?

Here are a couple of simple guides to follow. Simple as they are, though, avoid them at your peril:

Submarines work alone, or in pairs. The Russians especially like to run their subs in pairs, partially to make up for their inferiority in weapons and sensors. Submarines do not like to operate near friendly surface ships. There is too much chance of the friendly surface ships detecting and attacking the wrong sub. Keep the two types of units apart.

Surface ships operate in formations. They are rarely alone, because one ship will not be able to protect itself against all the different types of threat, and may just be too weak to survive. For example, an Aegis cruiser could handle any number of air attacks, but could not deal with a heavy submarine threat alone. Any ship can deal with one of anything, but the enemy rarely comes at you one at a time.

Escort all your ships, not just the big carriers. Underway replenishment ships can be sunk, too, and their loss can cripple your operations.

Large reconnaissance aircraft, such as the P-3 Orion or Tu-95 Bear, operate alone. They should stay away from any hostile forces because they are virtually defenseless. Just imagine them as radars with wings. They are very useful, though, so don't let them sit on the ground. It is very hard to escort or protect these planes, because they have such a long range. One of their strengths is being able to spot an enemy while he is still some distance away.

The smallest group of fighters to ever send out is a pair. Two aircraft can provide mutual support, and in case of a bushwhack by the other side, one will probably survive long enough to provide a warning. Two fighters can also do significant damage to an opposing group of aircraft, while one aircraft, especially if he is unlucky, may only injure their pride.

Strike aircraft, such as A-6 Intruders or Su-24 Fencers, should attack in packs. The minimum unit is a "flight" of four aircraft, or a "Vic" of three for some of the big planes like the Backfire. A flight delivers the minimum unit of firepower capable of accomplishing a mission. For example, against a small, defenseless merchant ship, you should send four aircraft armed with iron bombs. Everything else is tougher, and you should use multiples of four aircraft in making your plans. The ordnance would also vary with the

target, but more of that later.

Specialist aircraft may operate singly or in pairs. For example, a single jamming aircraft is usually assigned even to medium-sized raids, because of their effectiveness and their small numbers. Defense suppression aircraft usually work in pairs. These aircraft support the main strike. If the number of supporting aircraft grows too large, it reduces the number of planes available to the real mission.

FORMATIONS

Ships must be arranged in "formations" to provide for the best use of their weapons. They move in large groups, unlike subs, and relatively slowly, unlike aircraft. There is no need to worry about exact formations (at this level of play) for subs and planes.

Formations protect the large important ships (which usually have fewer defensive weapons) from attack by submarines, aircraft, missiles, and surface attack. This is done by surrounding the "High Value Units" or "heavies" with a ring of escorts. The escorts, or "screening ships", can shoot at the incoming enemy subs or aircraft or missiles before they attack the heavies.

Since there is more than one type of threat, the screen must balance the needs of each. A missile threat calls for a wide and deep screen, with the long range SAM ships positioned out along the line of possible attack (the "threat axis"). If there is a sub threat present, though, the ships must be bunched tightly around the heavies, because sonar and ASW weapons have a much shorter range than radars and SAMs.

If there is a threat of nuclear attack, the formation must spread itself out, so that not more than one or two ships will be lost to a single nuclear weapon. This may force ships too far apart to meet another type of threat, so the needs of nuclear and conventional defense should be carefully balanced. In addition, a wise commander will have an alternate formation plan so that if the ships are dispersed for nuclear attack, they can concentrate to deal with a conventional threat. Similarly, the formation should be able to quickly disperse if the chance of a nuclear attack increases.

The first step in planning a formation is to decide which is the most dangerous threat. Maybe a formation is out of range of enemy air bases, or the chance of sub attack is low, because there is a screen of friendly subs out ahead. Once that is done, apply the following guides:

Place the valuable units in the center of the formation, where they can be protected. This may include carriers, amphibious ships, auxiliaries, even a well-armed warship if that ship's survival is essential to accomplishing a mission. They should be placed about one nm apart. This group of ships is called the "main body".

Take the best-armed missile ship and place it out along the line of possible air attack, if known. Remember that air attack may also include missiles fired from a submarine. Its SAM envelope should cover the main body, just in case the attack comes from another direction, but place it as far from the main body as you can and still meet this requirement. For example, a missile ship with a range of 30 nm might be 20 nm out from the heavies. The farther out the missile ship is, the sooner it can start shooting at the bad guys.

The other missile ships should be spaced around each side of the first, with missile envelopes overlapping. Hopefully this can be arranged to surround the main body completely, but there may be gaps in the "rear". If so, keep a sharp eye on the air situation, and adjust the ship's position accordingly.

If there are enough ships, or you want to try a variation, set up an inner screen with short-range missile ships very close to the main body. These can provide a second layer of protection. Even one ship, placed along the threat axis near the main body, might catch a fey that the outer screen misses.

The submarine screen is similar, but more complicated. The ship's sonar ranges should overlap, but sonar ranges can vary. For instance, they are halved if a sub is below the thermocline. Some ships have variable depth sonars or towed arrays that go below the thermocline, but not all do, so look at the sonars your screening ships carry.

Sonar range is also halved (quartered below the layer) if the sub is creeping at five knots or less. If a sub is in front of your formation, all he has to do is sit tight, hardly moving, and if the screen does not detect him, he will get a close-range shot at the main body as they pass by.

In the front half of the screen, the ships must be closely spaced, so that a creeping sub below the thermocline cannot slip inside and attack. In back, a submarine must move quickly to close up with a moving formation.

Remember my example of putting a missile ship 20 nm out? A good sonar will have a range of 10 nm. Halved for the layer and halved again for creeping means a range of 2.5 nm. Overlapping the ranges slightly means two ships with 10 nm-range sonar will actually be spaced 4 nm apart. In back, they could be 8 nm apart, or if they have towed sonars, 16-18 nm apart. Quite a difference in spacing and capability.

One other thing: hull-mounted sonars have a blind zone aft, called the "baffles". Towed sonars, either variable-depth sonar or towed arrays, do not have this blind zone, so be sure that at least a few of the ships on the rear part of the screen have towed sonars.

If you have aircraft available, use them. Any large patrol planes should be well out in front looking for lurkers or subs trying to move into position in front of the formation. Helicopters with dipping sonar should be held in close, because of their shorter endurance and sensor ranges. Small helicopters, like the US SH-2F LAMPS, should be held on deck until a sub is actually detected. They have a short flight time, and it takes a while to hunt down and destroy a submarine.

Fighters should be placed on CAP (Combat Air Patrol) stations. These should be placed outside Friendly SAM range, so the fighters can attack the enemy inbounds before the SAMs engage. AEW aircraft, like the E-2C Hawkeye, should be placed close enough to the main body so that they are covered from all directions.

Once you have arranged your formation and gone in harm's way, look at the formation to see if it is still appropriate. Has the threat changed direction or in nature? Don't fiddle with the formation, but don't be afraid to readjust it.

ELECTRONIC WARFARE

This category of naval warfare is best described as the best use of the electromagnetic spectrum for your own purposes while denying it to the enemy. This includes radar, ESM, and jamming. Most of this is already built into the game, and is used automatically by the Staff Assistant. A fleet commander does not tell an individual ship when to use its jammers.

There are several factors that you should be aware of. Every time you use a radar, it sends energy out into space. Part of it bounces off ships and aircraft and shows up as echoes on a display screen. The rest can be detected by other radar receivers, specially designed to detect and analyze such signals. These signals can be detected out to the radar horizon, and

just a little beyond.

The best way to avoid detection is to not use your radars. But then you cannot use them to see possibly hostile contacts hundreds of miles away, in the dark or in the rain. Radar's value cannot be overrated.

There are several things that you can do. First, do not radiate all the time. By radiating intermittently, you lessen the chance that you are detected. Second, do not radiate everybody. Only a few units of your force may be able to provide the radar coverage needed. This at least prevents the other side from seeing exactly how many units are in your group.

If you have a carrier or land bases nearby, use radar planes, like the E-3 Sentry or the Il-76 Mainstay to cover your ships. This gives them radar coverage while allowing them to stay quiet.

Another tactic is to separate part of your group, a part able to defend itself, and let it radiate its radars. As long as they cover your force as well, and they remain near enough for you to support them, they will be relatively safe.

ANTISUBMARINE WARFARE

Submarines have the advantages of stealth and a powerful blow when they attack. A sub can be lurking outside a harbor mouth or well out to sea. It can attack with long-range torpedoes or even longer-range missiles. It can also pick the time and place of attack, when and where you are weakest.

To counter this you must concentrate your sensors on the most likely areas where a sub will be. If the opposition has a torpedo range of 10 nm, don't worry about looking for a sub 12 nm away. If you find one 12 nm away, kill it, but your search should only include those areas where subs are a threat to you. The others are non-threats, out of position and unable to hurt you. Searching the "threat zone" will keep you busy enough.

If you do get a contact, react aggressively. Don't let the sub get away. If he does he has regained his most important advantage: stealth. This means not only assigning units to track the sub, but also positioning units along lines where the sub might go if it does break away. Don't wait for the enemy to make a move. Predict possible moves and counter them in advance.

The weapon of choice for ASW is the airplane. Launched from land bases or carriers or other surface ships, aircraft are fast. They can be over as sub contact quickly. Also, they cannot be torpedoed. Using sonobuoys, MAD, or dipping sonar, they can localize a contact made by another unit, such as a ship with a towed array sonar. They are less efficient at picking up contacts on their own.

After aircraft, another sub is best. They have efficient sensors, although not as wide a variety as an airplane. They are also stealthy. The bad side is that it can take them a long time to reach a distant target, during which he might evade. Also, a sub-on-sub combat, even a surprise ambush, is never a sure thing.

The last choice in ASW is to attack with surface ships themselves. They have relatively weak, short-range weapons. Since many warships now have helicopters, a first choice, attacking with surface ships implies that the sub has already gotten by the first line of defense.

It is often best, when a sub is detected, to steer any surface ships directly away from the contact. If necessary, leave one or two ships with good sonars and helicopters near the sub to hold sonar contact, but get the main body and most of the screen away. This can only complicate the sub's life.

An ideal ASW defense would be to have a pair of submarines a hundred

miles or so in front of the surface group, then a long-range ASW plane patrolling behind them. It can support them, if need be, by catching any enemy subs that get past. The plane should be positioned 30-60 nm out.

The screening ships form the final line of defense. Hopefully they will detect an approaching sub first with their towed arrays, in the first or even the second convergence zone. Helicopters can then be launched to attack it.

Defending a formation is one side of ASW. There are others. The best place to sink a sub is in port. Attack sub bases with aircraft or cruise missiles. Mine them if you can.

Another way to catch subs is on their way to their operating area ("in transit"). If they must pass through a strait or other narrow area, patrol there. By using subs and patrol planes, you can catch some of them.

ANTIAIR WARFARE

This is the art of defending yourself from air attack. There are several threats: Long range missiles can be fired from submarines or aircraft. Aircraft can launch short-range missiles or drop bombs.

The best defense against air attack is called "defense in depth". By making the attack pass through several different layers of defense, each layer gets a shot. Not only does this kill enemy aircraft, but it breaks up his formation and ruins his timing.

The outer belt is made up of fighters on Combat Air Patrol, or CAP. They orbit out at over one hundred miles, and will attack any aircraft attempting to launch long-range missiles. At present, only the US Navy has aircraft with the range and firepower to perform a CAP mission. The Russian Yak-38 is not even a close match for an F-18.

Any fighter on the carrier's decks will be the next belt. Since they are not launched until after the enemy is detected they will attack when the aircraft are closer in. They may have already launched long-range missiles, or they may be trying to reach firing range.

The next belt of defense is the long-range SAMs. These will attack either long-range missiles or aircraft carrying short-range missiles as they close on the formation. Short-range SAMs will fire next, but cannot cover the whole formation.

The final line of defense is the individual weapons on each ship, called "point defenses". These are hopefully used to shoot down the last few "leakers" that have made it through the other belts.

The antiair defense of a formation in Harpoon is taken care of by the Staff Assistant. He will automatically engage any incoming threat, so that you, as a formation commander do not have to manage the many individual weapons systems. It is important, though, that you understand what the process is.

Presented with limited resources, the defender should set up the most effective defense he can. Your only consolation is that the attacker has limited resources as well.

ANTI-SURFACE WARFARE (ASUW)

Attacking a formation of surface ships is a difficult business. If the commander has done his job properly, the valuable targets are surrounded by a belt of escorts with interlocking sensor ranges and mutually supporting weapons.

The commander will be limited, however, by available assets. He may not have enough missile ships for complete coverage, or there may be gaps in his ASW coverage.

Your strategy will be governed by the tools available, but ideally attack a formation's weak spots. If the maximum defensive SAMs have a range of 30 nm, attack with a 40-nm missile. If they have a lot of ASW helicopters, attack with subs in bad weather. Feint an air attack while subs sneak in from the other side.

The weapon of choice for attacking ships is aircraft carrying long-range cruise missiles, long-range being defined as longer than their air defense range. In other words, the aircraft fly out, conduct a safe launch, then return. Aircraft are better than ship launched missiles because aircraft can draw their ordnance from the larger supplies at an airbase. Once a ship fires its load, it has to return to port.

A jamming aircraft would be assigned to confuse enemy radars and reduce the effectiveness of his missiles. If the target is distant, or the raid very large, an E-2C Hawkeye or Tu-95 Bear D might be assigned to supervise the strike and provide a radar picture for the commander. Finally, depending on enemy fighter opposition, one or more pairs of fighters would escort the mission.

Often there is a limited number of long-range missiles available, and some nations do not have them at all. Then the aircraft must use other measures to attack the ships as they fly through the target's defenses. A typical airstrike of eight aircraft (two flights) might have a pair of aircraft assigned for defense suppression, carrying ARMs.

The next-best weapon depends on nationality. US forces should attack with submarines. The Soviets should use ship-launched cruise missiles.

Soviet ASW is a general weak point, so if a US sub is in position to attack, it can usually sink a few ships. Torpedoes can't be shot down.

The Soviet subs stand a much tougher time against US ships, so they would rather attack with their large shipborne cruise missiles. They may coordinate their attack with subs if possible.

The chance of a surface ship gunfire duel is small unless both sides surprise each other, it is in restricted waters, or one side's speed is reduced by damage. When the first salvos are fired at a range of a hundred miles or more, the losing side can withdraw before the winners can close to the ten-mile range of even the largest naval guns.

STRIKE WARFARE

Naval warfare must be carried to the land, either by landing troops on his beaches (amphibious warfare) or attacking targets directly (strike warfare). Naval forces can attack with aircraft or land-attack missiles.

Land-attack missiles can simply be launched against a target. Aircraft attacking must be mixed so that the raid stands a good chance of survival. First there must be enough strike aircraft to do the job, carrying bombs or whatever ordnance the target requires.

If there is a chance of enemy fighters intercepting the raid, they should have friendly fighter escort, at least equal to the number of aircraft that might attack.

SAM and antiaircraft defenses must be suppressed, usually by aircraft carrying ARMs. These special purpose missiles will home in on the defending weapons radars, either destroying them or forcing them to shut down. "Iron Hand" aircraft usually work in pairs, and one or two pairs will be enough for a moderately-defended target.

One or more specialist jamming aircraft should also be assigned. These planes should be kept well back, out of hostile defense range. By jamming enemy search radars and missile guidance radars, they improve the chances of a raid's survival.

The ordnance the aircraft should carry depends on the target. Missiles should be used to destroy radars, ships in port, aircraft revetments, and other "point" targets. Bombs work on buildings and other larger targets. There is a special type of anti-runway ordnance that can be used to crater an airfield and prevent planes from taking off.

Sometimes raids can be coordinated. For example, a land-attack missile strike might hit point targets, with aircraft following up. Or if an important target is located near an airfield, send a raid to attack the field, or at least extra fighter cover to orbit between the enemy field and the target.

Although aircraft can be flown many times, they must survive each mission to be available for the next one. Even a loss rate as "low" as one in ten will add up quickly after a week of fighting. Always look for ways to make sure your aircraft not only accomplish their mission, but return home.

AIR WARFARE

Fighters are an important part of fleet defense, but they must be used carefully. While a fighter-on-fighter duel is exciting, it is also wasteful. Fighters exist to destroy bombers, tankers, reconnaissance aircraft, other things that can damage your forces and keep you from accomplishing your mission. Of all the aerial targets, fighters usually rank the lowest in target priority. If you have any choice at all, attack the bombers and reconnaissance aircraft. You will do much more damage to the enemy that way.

This does not mean that enemy fighters can be ignored. Your fighters will have to engage them, usually when one side or the other is escorting a raid. Depending on the exact type, there are general guidelines for attacking other aircraft.

First, attack from long range if possible. The best attack is one that the enemy cannot reply to. If you can launch radar-guided missiles at the enemy from outside his range, then there is no need to close quickly. In fact, you may be able to drive off the fighters without having to dogfight.

After range, numbers is the most important factor in winning an air battle. Having twice as many aircraft as the opposition means you will shoot his planes twice as fast as he does yours.

An important corollary to this is to look at the odds. There is plenty of honor in running if the odds mean that you are going to lose many aircraft to no gain.

Finally, do not dogfight unless there is an advantage for you in doing so. It is neither obligatory nor the best way of waging air combat. If you only have short-range IR missiles, and you have to stop the bad guys, you may have to dogfight. If you are much more maneuverable than your opponent, you may want to dogfight. But always remember that the mission has priority. Is engaging in a dogfight going to help or hurt your mission?

SUBMARINE WARFARE

A submarine is usually alone, and depends on stealth and surprise to stay alive. This means knowing and using sonar and the acoustic environment to maximum effect, because that is how a submarine detects the enemy, and the enemy detects him.

Sound is heavily affected by the water it travels through. What starts out as a straight sound ray can be bent, reflected, and weakened by variations in water temperature and pressure. These changes in the sound rays can be used to your advantage or disadvantage.

Familiarize yourself with the section on sonar. Without that information, you cannot use a submarine to its full effect. Always consider the effects of sonar propagation on your and your enemy's detectability.

The simplest example of this is the thermocline (or "the Layer"). If you stay below the layer, enemy surface ship sonars cannot hear you as well. If an enemy sub is below the layer, move above it.

Sometimes the enemy uses towed arrays. These sonars are towed below the layer, even if the towing unit is on the surface or at shallow depth. This means that even if the enemy unit is at shallow depth, to be across the layer from the towed sonar, you will have to be at shallow depth, too. Get your hull across the layer from his best sensors.

Speed is important as well. Creeping is the best way to improve your sonar's chances of detection and minimize your own. Even if you have to transit at high speed (which should be done at deep depth), slow down occasionally and listen.

When approaching a target, either submarine or surface, zigzag on either side of your base course. If possible, vary your speed. This will complicate the enemy's job of tracking you and getting a fire control solution.

It is just as important to evade enemy detection as it is to gain detection yourself. Stay deep to avoid MAD sensors. Move far out in front of the enemy, then creep in to minimize your signature. Evade the pickets, do not attack them. Your target is the main body.

Gather as much information about the enemy as your sensors will allow. Be very cautious about extending an ESM or radar mast, because if you are detected your ability to attack will be limited, and instead you will be on the defensive.

Pay careful attention to his capabilities when you attack. Even if you have sub-launched missiles, he may be able to defeat your salvo. It may be better to close for a more difficult torpedo attack which has a greater chance of success.

Consider your mission when you attack as well. Having gotten in close to the formation, choose your targets carefully. The nearest ship may not be the most valuable to the enemy. On the other hand, if it is necessary to ensure your survival, then it becomes the most valuable.

Never put yourself in a situation with a poor chance of survival. You are only cooperating with the enemy if you do. Even the worst attack is better than a good attack and a sunken sub. A sub that survives can attack again.

AMPHIBIOUS WARFARE

Most of the ship-to-shore movement and other niceties of amphibious warfare are built into the computer. What you have to concentrate on is the process of getting amphibious ships safely to the beach and supporting the assault.

An amphibious operation is the most complicated and risky operation in Naval Warfare. Ground units loaded in ships are vulnerable, and ships moving close to shore are also easy to attack. Worst of all, once the landing actually starts, there is a long period when the ships are committed to the landing and almost stationary. They cannot move away from the beach-head, and are easy for the enemy to find.

The area for an amphibious landing must be thoroughly cleared of opposition. Airbases must be neutralized, submarines hunted down and killed. In other words, the attacking force should have complete air and sea control before committing to the landing.

As much naval firepower should be assembled as possible to defend the landing area. The enemy will throw everything he has at the amphibious ships.

Set up submarine patrol zones some distance away from the landing force, then patrol with aircraft and ships inside the area. If you can attack even distant bases to keep the enemy from moving forces into your area.

Once the troops are ashore, you still have to escort the empty amphibious ships to port. You should also start exploiting your success. If the amphibious landing can capture an airfield, you can move your forces to it.

MINE WARFARE

Like amphibious warfare, mine warfare in Harpoon has been abstracted so that the players do not need to worry about the technical characteristics of the mines themselves.

Players should know about the threat mines can pose. Although cheap, mines can be laid in large numbers over an area, and not only sink ships but force them to avoid some areas, or spend precious time clearing them.

Mines near friendly ports will be automatically cleared as they are found. This will take time, though, and until a safe channel is cleared, friendly ships will be at risk.



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